

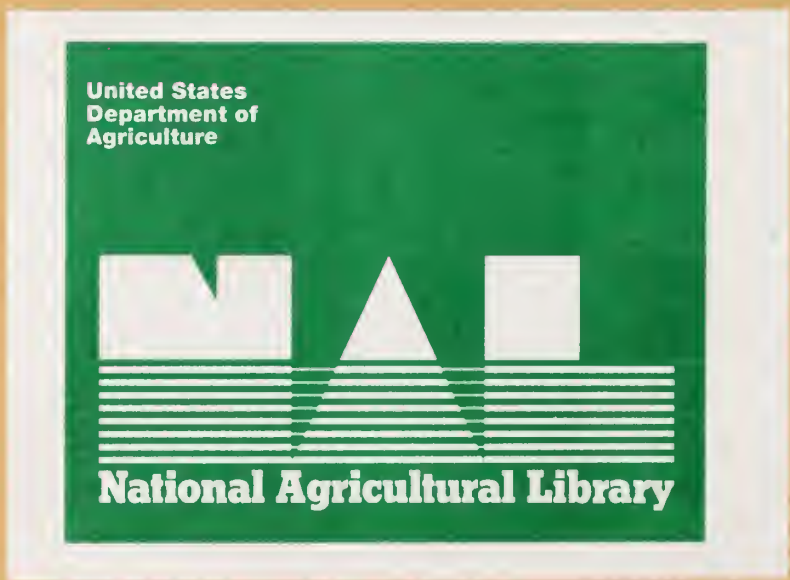
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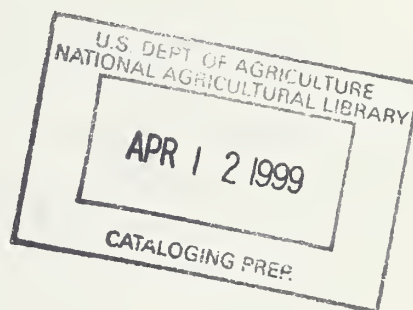


AN ACTION PLAN FOR
DOMESTIC PRODUCTION OF WEANING/SUPPLEMENTARY
FOOD FOR VULNERABLE GROUP FEEDING IN
BOTSWANA

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GABORONE, BOTSWANA

MARCH 1989



100-100

Domestic Production of Weaning/supplementary food for Vulnerable Group Feeding in Botswana

An Action Plan

March 1989

1. BACKGROUND

1.1 General

The Government of Botswana (GOB) has been distributing relief foods, including ICSM/CSM, to vulnerable groups throughout the country. During non-drought years, medical criteria are applied in the selection of beneficiaries. During drought, the entire target groups are included in the vulnerable group feeding programs thus increasing the food demand in the program by 3 to 4 fold over non-drought years. The Food Resources Department, Ministry of Local Government and Lands maintains food warehouses and transportation capabilities and the Ministry of Health oversees an extensive MHC program through which foods are channeled to under fives. In 1987, a drought year, 26,000 MT of ICSM were distributed to various beneficiaries. The prevalence of malnutrition (less than 80% weight for age) in children under five declined from 30% in 1982 to less than 20% in 1988. CSM was one of several factors believed responsible for this reduction.

However, it is the policy of donor agencies to phase out the donated supply of ICSM/CSM by July 1990. In order to safeguard the availability of suitable commodities in the GOB food provision programs, the GOB is considering the possibility of an in country manufacturing capability for ICSM/CSM substitutes using, as far as is possible, indigenous raw materials. Accordingly, in the fall of 1987, the GOB requested the assistance of the World Food Program of the UN and the U.S. Agency for International Development (USAID) to examine the issues concerning domestic manufacture of supplementary foods for vulnerable groups.

A consultancy was carried out in March 1988 to examine such issues and the final report ^{a/} was issued August 1988. It was recommended in the report that the GOB undertake a project to have produced in the private sector 4,000 MT/year of an 80% maize, 20% soybean precooked weaning food for use in GOB feeding programs for medically identified malnourished 5-59 month old children starting after July 1990 when donated supplies of CSM/ICSM would no longer be available. Only 4,000MT weaning food would be available in both non-drought and drought years. Other food needs would be filled by use of a food basket.

1.2 GOB decisions on domestic weaning food.

The GOB responded to the consultant's report in a letter to USAID dated January 27, 1989. In that letter, the GOB announced several decisions pertinent to the weaning food.

1.2.1 Eligibility for weaning food

1.2.1.1 **Non Drought.** All children between 4- 36 months medically identified as undernourished would be eligible to receive the weaning food. Additionally, all children found to be severely malnourished would receive a double ration. The ration is 150 grams/day.

For 1990, eligible recipients are estimated to be 25,430 of which 78% are reached or 19,835. These actual recipients would utilize 1,086 MT weaning food. Adding 50% for special programs gives a total weaning food demand of 1,629 MT/year (see calculations in Table 1).

^{a/} WFP and USAID. August 1988; Gaborone, Botswana. Report of Consultancy to Examine Issues Concerning the Domestic Manufacture of a Supplementary Food for Vulnerable Groups.

1.2.1.2 Drought conditions. All children 4 - 36 months in rural areas and urban children 4 - 36 months medically identified as undernourished would be eligible for weaning food. Additionally, all children in rural areas found to be undernourished will receive a double ration. The ration quantity in drought is 150 grams. If 1990 is a drought year, 106,804 children are estimated to be eligible for rations. Approximately 5,430 MT of weaning food would be required for the year (see calculation in Table 2). This level is 3.3 times the requirement of 1,629 MT in non-drought years. Such large differences in demand for weaning food between non-drought and drought years pose a difficult problem from the production point of view. Since production equipment operates most economically at near maximum capacity, the requirement for sufficient drought-demand production capacity will have as a consequence that in non-drought conditions, the plant is operating at only 30% of its capacity resulting in an unacceptably high overhead.

Table 1

Calculation for Weaning Food Demand in
Non-Drought - 4-36 months

| | |
|---|---------------|
| 4 - 36 months old | 127,148 |
| 20% are undernourished | 25,430 |
| Only 78% are reached | 19,835 |
| Ration is 150 grams | |
| MT for undernourished = $19,835 \times .150 \times 365$ | |
| 1,000 | 1,086 MT |
| Add 50% for special programs | <u>543 MT</u> |
| | 1,629 MT |

Table 2

Calculation for Weaning Food Demand in
Drought 4 - 36 months

| | | |
|---|---|---------------------------|
| o | 4-36 month olds | 127,148 |
| o | If 80% (ref: EPI Evaluation 1987) of the population is rural, than the rural recipients | = 127,148 x 80% = 101,718 |
| o | Urban undernourished = 127,148 x 20% x 20% = | <u>5,086</u> |
| | Total recipients | 106,804 |
| o | 2 x ration for rural undernourished = 101,718 x 20% | <u>20,344</u> |
| | Total rations | 127,148 |
| o | However only 78% of eligible recipients are reached 127,148 x 78% = 99,175 rations required | |
| o | MT = <u>99,175 x 150 kg/day x 365 days</u> | = 5,430 MT |
| | 1,000 | |

Accordingly, it is recommended that the GOB reconsider the weaning food eligibility issue. A reasonable solution is to continue the same weaning food eligibility criteria stipulated for non-drought in drought as well. Those children not medically identified as undernourished in drought in the rural area would receive a food basket which will counter balance the reduced availability of local food stuffs due to drought and thus allow these children to retain adequate nutritional status. In this fashion, there will likely be little difference in weaning food demand between non-drought and drought. Under these conditions, realistic plans can be laid

for the economic production of weaning food that meets projected demand under both non-drought and drought conditions.

1.2.2 Type manufacturing process. Low-cost extrusion cooking was chosen as the preferred process to manufacture the weaning food. It is further stipulated that the product should be "partially cooked" so as to require some cooking in the home (water sterilization).

1.2.3 Ingredients. The weaning food will be composed of a blend of decorticated sorghum flour/meal and dehulled, fullfat soybean flour/grits which is extrusion cooked. The product will be vitamin and mineral fortified subsequent to extrusion. At a later date, depending on availability of groundnuts and cowpeas, these will be substituted for the soybean. That the GOB sees the weaning food evolving beyond the current formulation suggests it may be desirable for the GOB to train some of its employees in the field of food technology so that it will have the capacity in the future to carry out this and such other food technology tasks that may arise.

1.2.4 Time allotted for product development. The GOB stipulates that 6 months be allowed for product development (and acceptability studies). Whereas the consultants had suggested a 3 month period for this activity where the product was to be maize/soybean, increased time will be required for a sorghum/soybean based product about which much less is known. Maize/soybean is essentially very similar to CSM, a product already accepted in vulnerable group feeding programs.

1.2.5 Private sector versus public sector production capacity. The GOB accepted the consultant's recommendation that the weaning food production capacity be established in the private sector.

The GOB change in weaning food eligibility criteria from 5-59 months old medically identified undernourished children to 4-36 months has reduced the annual demand from 4,000 MT to 1,629 MT under non-drought conditions. At this lower market potential,

it will be significantly more difficult to attract private companies into the business such as Sefalana or the Francistown Milling and Trading Company. These companies are primarily maize millers, have small or no sorghum processing; and do not have extruder cookers. They would require significant planning effort and capital expense for a low margin (government business) small market. On the other hand, the Food Botswana interest will probably not decline since this company is a major sorghum miller and processor, already has 90+% of capital expenditure for weaning food production behind it, and essentially has on board 100% of the technical expertise required to produce extrusion processed weaning food. If a Request for Proposals (RFP) goes out to the industry at the 1,629 MT/year level, there is a strong likelihood that only Foods Botswana would respond.

1.2.5 Project Management. The GOB has assigned project coordination to the Ministry of Health (MOH) but within MOH, no individual has been assigned overall project responsibility. The GOB visualizes obtaining a Project Manager from outside government to work within MOH. The GOB further visualized that if this person were a food technologist, then this individual could also fulfil a large portion of the project's need for technical assistance in product development and marketing. Accordingly, a request was made to WFP to provide funding and recruit such a person for a two year period.

2. ACTION PLAN

2.1 General. The consultants, in their prefeasibility study, visualized the project in five phases:

- (i) Prefeasibility Study
- (ii) Organization for the Project
- (iii) Product Development and Marketing
- (iv) Contracting
- (v) Production

The consultant's August 1988 Final Report constituted the Prefeasibility Study leaving Phases II through V for completion.

2.2 Phase II. Organization for the Project

2.2.1 Policy guidance. The GOB (Ministry of Finance and Development Planning - MFDP) has given the following guidance in its letter of January 27, 1989:

- 1) The product will be a sorghum/soybean based weaning food fortified with vitamins and minerals. This is considered an interim product to be replaced with a sorghum/groundnut/cowpea based product when groundnuts and cowpeas are adequately available.
- 2) The product shall be a partially precooked product such that the user will be required to apply further cooking in the home.
- 3) Low-cost extrusion cooking (LEC) will be employed as the precooking process.
- 4) Manufacture will be in the private sector in Botswana.
- 5) Recipient eligibility criteria were laid out (see 1.2.1.1 and 1.2.1.2) that indicate demand levels of 1,629 MT in non-drought years and 5,430 MT in drought years and imply a budgetary commitment to purchase such quantities.
- 6) Designated MOH as the project coordinating agency.
- 7) Noted that donated CSM/ICSM will not be available from donors after January 1990 thereby implying domestic production capacity should be available January 1990.
- 8) Indicated that up to 6 months should be allocated to product development and marketing (acceptance) studies.

Analysis. This is adequate policy guidance for MOH to proceed to organize for the project and prepare an action plan and budget and submit it to MFDP for approval.

However, the GOB may wish to review the guidance in light of further comments by USAID consultant Dr. David Fellers. The comments are in three areas.

First, the GOB may wish to reconsider eligibility criteria in drought so that it is the same as in non-drought, that is, medically identified undernourished children (4-36 months) plus special programs. This would remove the variation in weaning food demand between drought and non-drought and thus allow the weaning food manufacturer to plan a factory of such size that it could operate at a high percentage of capacity year in and year out. Those children losing eligibility in drought would receive a lower cost food basket in place of the weaning food. Since the parents of these normal children have been successful in preventing malnutrition during non-drought, there is a high expectation that they can continue to achieve good nutritional status in their children as long as they receive the traditional foods (sorghum meal, maize meal, pulses, and vegetable oil) that are likely to compose the Food Basket. If the eligibility criteria are not changed, it is likely that demand for weaning food during drought could not be met.

Second, the choice of sorghum over maize as the cereal component of the weaning food has cost and risk implications. The GOB has considered the cost implications and determined that the National agricultural priority for sorghum outweighs its added cost (estimated at 21% higher than maize based weaning food). However, a second issue regarding sorghum that may not have been considered is the greater risk of failure due to an inability to produce an acceptable product.

It is known that CSM/ICSM products are successful in vulnerable group feeding programs. A maize/soybean product will be very similar to CSM and thus the risk of failure is small. Acceptance tests would basically be confirmation tests that the maize/soybean product mimics CSM in flavor, texture, and response to established methods of preparation for consumption. On the other hand, much less is known about sorghum. Sorghum meal is often fermented overnight before porridge preparation the next day. If mothers perceive the

sorghum based weaning food as sorghum meal, will they try to ferment it? How would this affect acceptability. How will the government control the potential use of lower cost, bird resistant type sorghums in the product which, due to their high tannin contents, adversely impact nutritional quality? To answer such questions will require significantly greater product development effort and field tests.

An alternative that might be considered that would aid rapid mobilization of domestic weaning food with minimum risk is to proceed first with a maize/soybean product. Research effort could commence on a sorghum/soybean product which if successful could be phased in to replace the maize based product. A disadvantage of this approach could be disruption of weaning food production if the weaning food plants were designed only for maize based products.

Another advantage of maize is its broader availability, that is, from both South Africa and Zimbabwe while "food grade" (red and white) sorghums are only available from South Africa, beyond that domestically produced.

Third, the GOB indicates January 1990 as the date after which donor supplied CSM will no longer be available. USAID has given this date as July 1990 which suggests domestic weaning food production capacity should be available by July 1990. GOB and USAID need to agree on which date is correct.

2.2.2 MOH Organization for the Project. The weaning food project is a series of activities that will be carried out by various groups (GOB, private sector, and donor provided technical assistance) directed and coordinated by MOH. These activities are intended to lead to the production of low-cost weaning food in the private sector for government purchase. Therefore, MOH's primary need is for project management and budget. Approximately 15 months (see Figure 1) are estimated from the current time (March 1989) to the production Phase at which time the Ministry of Local Government and Lands (MLGL) would take over procurement, warehousing, and distribution of the domestically produced weaning food.

Figure 1

3/13/89

Weaning Food Project - Action Plan



○ External Technical Assistance □ Local Technical Assistance

1. Production will be available if Foods Botswana is a contractor. If not, product is at least one year away.

X1/ X1/

It is estimated that the project management duties might consume 25% of the time of a well qualified, experienced manager. Four approaches have been discussed to meet the MOH need for Project Management:

- 1) MOH appoints a qualified Project Manager from within MOH to take on this extra responsibility for the duration of the 15 months (April 1989 - July 1990).
- 2) MOH appoints an interim Project Manager from within MOH while recruiting a local hire to take on this task. Because the project should not require full time, the individual would probably be assigned additional duties.
- 3) MOH appoints an interim Project Manager while WFP seeks funding and recruits a Project Manager who would also have technical skills (probably food technology) and who could meet some of the demands for technical assistance required in the project.
- 4) MOH contracts out the Project Management job (e.g. Food Technology and Research Center) while reserving oversight responsibility for itself.

Option #1 (MOH Project Manager for full 15 months) provides for an early start, continuity, and institutional capacity building and is recommended.

2.2.3 Budget. The MOH will require a budget to complete the work. Procurement of goods and services for the project can follow routine MOH procurement procedures. The Project Manager should have authority over the project budget. Table 3 presents an estimated budget. MOH personnel working on the project and their support services (telephone, travel, per diem, secretarial etc) are provided to the project at no direct cost to the project. It is expected that the services of several MLGL employees associated with MCH activities will be called on to act as interviewers for field studies on the weaning food acceptability. These interviewers will need to

Table 3

Budget Required to Implement the Weaning Food Action Plan

| Activity | GOB | Donor |
|--|----------------|----------|
| 1. Product Development and Procure 1.5 MT Prototype Weaning Food | P 7,100 | |
| 2. Storage Stability Studies contract | P 4,200 | |
| 3. Marketing Research and Acceptability Studies | P15,100 | \$7,000 |
| 4. Evaluation/Critical Review of Product Development, Storage Stability and Market Research and Acceptability Studies | P 5,700 | |
| 5. Prepare RFP | - | \$7,000 |
| 6. Evaluate Proposals | - | \$7,000 |
| 7. Miscellaneous and Contingency | <u>P 3,200</u> | <u>-</u> |
| Totals | P35,300 | \$21,000 |

attend a central (probably Gaborone) 2 to 4 day training session in addition to their interview activities in the field. MLGL personnel working on the project and their support services are provided to the project at no direct cost to the project.

Table 4 lists the technical assistance, both external and local that is required for the project.

2.2.4 GOB Decision on Action Plan and Budget. The MOH Nutrition Unit and USAID Consultant have formulated this Action Plan and Estimated Budget. The MLGL has not been consulted regarding their proposed inputs. The Action Plan and Budget were prepared during the period March 6 - 17, 1989. The time line of the project (Figure 1) calls for approval of the Action Plan and Budget by the MFDP during the latter part of March 1989. The Action Plan suggests reconsideration of some of the MFDP policy guidance issued January 27, 1989. Approval of the Action Plan and Budget and any adjustment in Policy Guidance will be accepted by MOH who will then implement the project.

2.3 Product Development and Marketing

2.3.1 Preliminary Composition/Specifications of the Weaning Food. These are set forth in Table 5 and will guide the development of a prototype weaning food for use in subsequent storage stability studies, market research, and acceptability studies. These specifications are designed to produce a Sorghum Soybean Blend Product that meets the Codex Alimentarius Guidelines for Older Infants and Young Children (FAO/WHO 1985).

2.3.2 Develop Product and Procure Prototype. Foods Botswana is immediately prepared to work with the MOH to develop and produce prototype weaning food (see Annex 1, Telcon between USAID Consultant, Fellers and Nicholson at Foods Botswana 3/9/89). MOH will retain a technically qualified food technologist (local consultant) to be on hand at Foods Botswana to observe, verify, and report the procedures and results of the product development trials and production of the prototype weaning food. The consultant will inspect and report on the type, quality, source, and cost of ingredients used. It is

Table 4

Technical Assistance Required in Weaning
Food Project to Implement Action Plan

1. Product Development and Production of Prototype Weaning Food.
 - A. Nigel Nicholson, Managing Director, Foods Botswana.
 - B. Local Consultant. Potential sources: Food Technology and Research Center or ICRISAT at Bulwayo. Purpose: To observe, verify and report on product development on behalf of MOH.
2. Storage Stability Studies. Local Consultant. Potential sources: Food Technology and Research Center or ICRISAT at Bulwayo.
3. Market Research and Acceptability Studies.
 - A. External Marketing Expert. Potential source: USAID or WFP. Purpose: Set up market research and acceptability studies and train interviewers.
 - B. Local Consultant. Work with 3.A. and manage the implementation of focus group studies and acceptability studies and prepare final reports for each.
4. Evaluation. Local Consultant. Potential sources: ICRISAT at Bulwayo or Food Technology and Research Center. Purpose: To prepare a critical review summarizing Product Development, Storage Stability, Focus Groups and In-House Acceptability Studies. Provide a list of conclusions and recommendations.
5. Contracting.
 - A. External Food Technologist/Food Process Engineer. Potential source: USAID or WFP. Purpose: Finalize product specifications, assist preparation of the Request for Proposals (RFP) and assist in preparation of a regulatory plan.
 - B. External Food Technologist/Food Process Engineer/Cost Analyst. Potential source: USAID or WFP. Purpose: Evaluate Proposals resulting from RFP and make recommendations. (If only one proposal is received [Foods Botswana], this consultant will not be needed).

Table 5

Specifications and Guidelines for Production of
Sorghum-Soybean Blend Weaning Food (SSB)

Final Product Specification

The sorghum soybean blend shall be processed and packaged in the Republic of Botswana under hygienic conditions utilizing wholesome, food grade ingredients. The final product shall be essentially free from foreign matter and shall have a good characteristics taste and odor, free from burnt, rancid, bitter, musty, sour and other undesirable or foreign tastes and odors. The color will not be darker than the color of good quality food grade sorghum meal made from red or white sorghum and typically found in the Botswana market place. The final product shall be of small particle size suitable for use as a dietary supplement for infants and young children for serving as a porridge, gruel, or an extender to other foods. The product shall not contain hard, ungelatinized particles. The product shall meet the following requirements listed in Table A.

Table A

| Item | Requirement 1/2/ | |
|---|------------------|---|
| | Minimum | Maximum |
| Moisture, % | - | 9.5 |
| Protein (N X 6.25) % | 17.0 | - |
| Fat, % | 6.0 | - |
| Crude Fiber, % | - | 1.7 |
| Material that will pass through a US Standard No. 6 woven-wire-cloth, % | 99 | - |
| Material that will pass through a US Standard No. 30 woven-wire-cloth, % | - | 92 |
| Material that will pass through a US Standard No. 60 woven-wire-cloth, % | - | 70 |
| Urease Activity, increase in pH | - | 0.50 |
| Consistency (uncooked) cylinder/plate method 3/ | - | _____ cm (to be determined by experi- mentation) |
| Total Bacteria Count per gram | - | <u>50,000</u> |
| Salmonella, E. Coli, and Coagulase Positive Staphylococci shall be negative | | |

1/Unless otherwise specified, analyses are expressed on a moisture free base.

2/Chemical and physical methods used to determine compliance with specifications shall be those current methods of the Official Methods of the Association of Official Agricultural Chemists, the American Association of Cereal Chemists or the American Oil Chemist's Society.

3/Consistency by Cylinder/Plate method.

APPARATUS

- 1 800 ml. pyrex beaker
- 1 wooden-handled spatula with 13cm stainless steel blade
- 1 cylindrical open-bottom container i.e. a 7.62 cm long section of seamless steel tubing i.e. 7.62 cm outside diameter and 7.29 cm inside diameter
- 1 glass plate 25cm x 25cm
- 1 paper measuring scale, 25cm x 25cm containing a drawn 7.62cm diameter center circle and concentric circles drawn of increasing diameter every one cm.

Method

Place 400 ml of water at 25°C in a 800 ml glass beaker. Gradually add 125 g. sorghum-soybean blend while stirring vigorously with a wooden-handled spatula with a 13 cm stainless steel blade. Then stir gently for 3 minutes using a spatula to smooth any lumps that may form. Allow the slurry to stand an additional 2 minutes for hydration. Then stir gently for about 10 seconds with the spatula. Place a glass plate over a paper measuring scale and center the cylindrical container over the scale. Transfer the slurry to the retaining cup which is resting in the vertical position on the flat glass plate. Transfer the slurry until the cup is filled higher than its top level. Strike off the excess with a straight edge. Allow the slurry to rest for 30 seconds. Then remove the cup from the glass plate with a vertical pull, avoiding lateral motion. Allow the cup to drain onto the patty for 10 seconds. After waiting one minute for the size of the patty to reach equilibrium, read its diameter to the nearest cm as shown on the scaled sheet of paper underneath the glass.

(Comment: The test is necessary to insure the product has receive adequate precooking in the extrusion process and that trypsin inhibitor in the sorghum is destroyed. The proper specification will be determined by experimentation. The specification will be a "maximum value". Once the value is determined, the Discount Quality Schedule can also be completed.)

Quality Discounts

If the product loaded out by the Contractor does not meet the quality specifications listed in Table A but falls within the limits listed below, the product may be delivered to the Food Resources Department but the purchase price shall be reduced in accordance with the following schedule of discounts. The discounts are listed as a percentage of the tender price.

Excess Moisture, %

9.6 or 10.0 - discount 0.5%
 10.1 or 10.5 - discount 1.5%
 10.6 or more - reject/negotiate

Excess Crude Fiber, %

1.8 or 1.9 - discount 0.5%
 2.0 or 2.1 - discount 1.5%
 2.2 or more - reject/negotiate

Deficient Granulation through
No. 6 Woven-Wire-Cloth, %

98 or 97 - discount 0.1%
 96 or 95 - discount 0.3%
 94 or less - reject/negotiate

Excess Granulation through
No. 60 Woven-Wire-Cloth, %

71 or 75 - discount 0.2%
 76 or 80 - discount 0.6%
 81 or more - reject/negotiate

Deficient Protein, %

16.9-16.5 - 0.7%
 16.4-16.0 - 2.0%
 15.9 or less - reject/negotiate

Deficient Fat, %

5.9-5.7 - 0.5%
 5.6-5.5 - 1.5%
 5.4 or less - reject/negotiate

Excess Granulation through
No. 30 Woven-Wire-Cloth, %

93 or 94 - discount 0.1%
 95 or 96 - discount 0.3%
 97 or more - reject/negotiate

Excess Consistency, cm

To be completed when
 experimentation has revealed
 the appropriate specification
 in Table A.

Proportions (Formulation)

| Ingredients | kg per 1000 kg Batch |
|--|----------------------|
| Dehulled sorghum 1/ } Blended and | |
| Dehulled soybean 1/ } extruded - - - - - | 972 |
| Mineral mix | 27 |
| Vitamin mix | 1 |

1/The dehulled sorghum and dehulled soybeans are blended in the proportion of 3 to 1, ground to a fine particle size (may require double grinding) and extrusion cooked. If particle size is not sufficiently reduced before extrusion, the final product may show evidence of unacceptable, hard, ungelatinized sorghum particles.

Ingredient Specifications

Dehulled Sorghum. Only red or white sorghums, grades 1 or 2 (Botswana Agricultural Marketing Board) shall be used in the preparation of dehulled sorghum. Additionally, to insure freshness and to avoid stale flavor in the resulting weaning food, the red or white sorghum must display a minimum of 80% germination viability. To minimize darkening of the weaning food, the red or white sorghum shall not contain more than 4% non-bleachable seeds by weight. To insure against the presence of bird resistance type (high tannin) sorghums, the red or white sorghum for use in the weaning food shall pass the "flotation" test wherein not more than 45% of the seed shall float in the prescribed test. Copies of the methods for these three tests may be obtained from the ADO (Paul Daly), USAID, Gaborone. The project is grateful to Foods Botswana, Serowe that has made the methods available. Dehulling means the complete removal of pericarp material. Dehulling typically yields 80 to 85% dehulled sorghum when starting with clean sorghum. The dehulled sorghum will be freshly manufactured for use in manufacture of the sorghum-soybean blend.

Dehulled Soybeans. (Need to obtain appropriate soybean grain standards to quote here). Dehulling means the nearly complete

removal of hull. Dehulling typically leads to a 95% yield of dehulled soybeans when starting with clean, sound soybeans. (If dehulling is not satisfactory, it can usually be improved by drying the soybeans to remove about 1% moisture before dehulling).

Mineral Premix

The mineral premix is identical to that used in Blended Food Products, such as CSM, used in the USA Food for Peace Program.

Amount for 1000 kg of
Product

| | |
|--|----------------|
| Tricalcium Phosphate 1/ | 20.00 kg |
| Zinc Sulfate, Hydrated ($\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$) | 0.04 kg |
| Ferrous Fumarate | 0.46 kg |
| Iodized Salt (0.007% I_2) | <u>6.50 kg</u> |
| | 27.00 kg |

1/Tricalcium Phosphate has an inhibitory effect on insects if sufficiently fine in particle size. Accordingly an apparent specific gravity of 0.55 grams per cc or less is specified. The cost of Tricalcium Phosphate is higher than other sources of calcium. A suitable lower cost source of calcium that may be substituted is food grade calcium carbonate.

Vitamin Premix

The vitamin premix is identical to that used in blended foods, such as CSM, used in the USA Food for Peace Program.

| | Amount for 1000 kg of Final Product |
|--|--|
| Vitamin A (as palmitate) | 16,500,000 USP units |
| Vitamin D ₃ (Cholecalciferol) | 1,980,000 USP units |
| Vitamin E (di Tocopherol Acetate) NF | 74,800 IU |
| Ascorbic Acid, USP-FCC | 400.4 grams |
| Niacin, NF-FCC | 49.5 grams |
| Calcium Pantothenate, USP-FCC | 27.5 grams |
| Riboflavin, USP-FCC | 3.85 grams |
| Thiamine Mononitrate, USP-FCC | 2.75 grams |
| Pyridoxine HCl, USP-FCC | 1.65 grams |
| Folic Acid, USP-FCC | 1.98 grams |
| Cyanocobalamin, USP (Vitamin B ₁₂) | 0.040 grams |
| Butylated Hydroxyanisole (antioxidant) | 22.0 grams |
| Butylated Hydroxytoluene (antioxidant) | 22.0 grams |
| Corn Starch, USP | To make 1 kg |

Guidelines for Extrusion Processing

Experience with Anderson extruders on similar cereal/oilseed blends suggests that processing conditions be in the range of 16 to 20% moisture and an extruder discharge temperature of 154° to 166°C. Under these conditions a desirable, slightly toasted or nutty odor/flavor is developed, "raw" cereal flavor is destroyed, trypsin inhibitor of soybean is adequately destroyed, and starch gelatinization/dextrinization occurs to give a proper consistency and caloric density to the final product. Under these extrusion conditions, ambient cooling air should be sufficient to dry the product below the desired 9.5% moisture content.

The GOB has stipulated that the Sorghum-Soybean Blend (SSB) be "partially precooked." This is to insure that the homemaker has to apply an additional short (2 minute) cook before serving. This cook insures that cooking water is brought to the boil minimizing any contamination the water might have. However, because of the need to inactivate trypsin inhibitor it is not desirable to reduce extrusion moisture or temperature. Furthermore, the improved acceptability due to the slightly toasted flavor might be lost. To achieve the GOB's goal, the project will rely on package labelling, instructions for preparation and particle size of the SSB. By specifying a coarse particle size, as has been done, the SSB will have to be cooked in order to achieve the smooth, soft texture that indicates the product is ready to eat.

expected that product development and production of the prototype will take less than a week. The consultant will arrange through Foods Botswana or their own organization to obtain duplicate proximate analysis of a representative sample of the prototype product and a particle size analysis (sieve analysis) which will be included in their report. Food Technology and Research Center or ICRISAT at Bulawayo are believed to have the appropriate personnel for this consultancy.

As noted in 2.3.1 above, the preliminary composition/specifications indicated in Table 5 will guide Foods Botswana in this product development phase. Deviations from these guidelines should be agreed to by the consultant in attendance and explained in the report why the deviation is necessary or desirable.

The quantity of prototype weaning food required by MOH is 1.5 MT. It should be packaged and labeled in large sacks, for example 25 K polypropylene sack, with a polyethelene inner liner or bag. MOH will arrange to take receipt of the 1.5 MT at the Serowe factory and transport it to GOB storage facilities until needed.

MOH is expected to cover Foods Botswana material costs (sorghum, soybeans, bags etc) plus 25% overhead to cover electricity and other operating costs. See Annex 1. The maximum materials to be used are 6 MT food grade sorghum meal and 2 MT soybeans. Other than small samples to be saved for further observations by MOH excess experimentally processed weaning food will be retained by Food Botswana for use in animal feeds as a further offset of their costs.

2.3.3 Storage Stability of Prototype Weaning Food. MOH will contract storage stability studies on the prototype weaning food. Food Technology and Research Center or ICRISAT at Bulawayo are believed to have the appropriate personnel and facilities. Accelerated storage studies should be utilized so that results can be available for product reformulation or other remedial action before the product development phase is completed. Therefore, storage conditions at 30°, 40° and 45°C

should be considered. The critical evaluation parameter is acceptability (odor, taste, and color change). Limited chemical analyses may be appropriate and should include moisture history of the product during storage, and possibly free fatty acids and some method of following oxidative rancidity.

A second part of storage stability testing is to develop a periodic sampling and testing of the 1.5 MT of prototype weaning food in its storage area. This experiment is a confirmation of the laboratory studies discussed above and also serves to provide information on quality of the prototype when it is eventually used in focus group and in-house acceptabilities studies.

2.3.4 Market Research and Acceptability Studies. this subject will entail two distinct activities. The first is "Focus Group Interviews" and the second is "In Household Placement Acceptability Trials." A marketing expert consultant is proposed to be retained by MOH (possible TA from USAID or WFP) for about 2 weeks to develop the specific agendas for both activities and to train the interviewers that will be needed. A local consultant will also be retained to work with this marketing expert and to manage the market research and acceptability studies to their completion after the marketing expert has left and to prepare reports on their results.

The population of Botswana has three major culturally distinct areas: the East, for which sorghum is considered the traditional grain; the West where maize is traditional; and the Northwest where millet is traditional. Quantitatively, 80% of the population is in the East, 5% in the West, and 15% in the Northwest (rough estimates; Ref. T.O. Maribe discussions 3/9/89). It is desirable to carry out studies in each area with greatest emphasis on the East. Time or budgetary constraints may impact on whether or not the West and Northwest are covered.

2.3.4.1 **Focus Group Studies.** The methodology is to recruit 8 to 10 potential users (mothers) of the weaning food and bring them all together for a presentation, product demonstration and tasting, and open discussion. The group is led by a trained interviewer working from a set of specific objectives and questions for which information is sought. The interviewer collects questionnaires and prepares a narrative to record the results after each group meeting. Several such focus groups would be convened around the country. A final report is prepared by the local consultant, responding to the original list of objectives and questions, providing any additional pertinent information discovered, and making recommendations.

The purpose of the focus groups is to learn from potential consumers how infants and young children are fed, to determine if any problems can be anticipated in the change from CSM or traditional products to SSB (Sorghum-Soybean-Blend), to show and demonstrate the prototype SSB and obtain reaction on flavor, texture, desired thickness, method of preparation and so forth, to determine if there is likely to be a fermentation role in preparation, and etc. Such information will be needed for use in educational programs when the new product is distributed, for recipe development and instructions for preparation, and for labeling. The effort might also include testing several names for the product to achieve the desired image (National pride; high nutritional value; for infants and young children under three years) for the product.

Potential sources of the local consultant are the Food Technology and Research Center, ICRISAT at Bulawayo, or Business Development Services (Pty) Limited of Gaborone. Each of these groups are believed to have skills in marketing research.

The precise plan of Who, What, Where, When and Why will be provided by the expert consultant in consultation with MOH. Both MOH and MLGL should prepare lists for the marketing expert expressing their ideas in this area and their perceived needs for information from the focus group study.

2.3.4.2 In Household Placement Acceptability Trials. The approach here is to locate target families that have 4 - 36 month old infants/young children, determine baseline information through interview on their socio-economic situation, employment, family size, methods of baby food preparation and products used (especially CSM), breast feeding, and other pertinent information. Secondly, the acceptability trial would be explained to the household, sufficient product given for 2 weeks (150 grams/day/infant-child 4-36 months --- 2 one kilogram bags for the 2 week period), and that the interviewer will return after 2 weeks to get the household's reaction to the new product. The first interview is called the "placement interview" and the second is called the "callback interview."

The specifics of the household trials will be developed by the marketing expert consultant during the same TDY (temporary duty) involving focus group studies. The expert will train interviewers directly or will train a local trainer (probably the local consultant) who will in turn train interviewers. Both MOH and MLGL should prepare lists of their concerns regarding such tests --- logistics, desired information, consumer selection criteria, who the interviewers should be, what information should be given the consumer, MCH centers, or other local groups, and so forth.

Initially, for planning purposes, the number of households to be tested has been set at a total of 150 in the East in a few different locations, 50 in the West and 50 in the Northwest. These numbers may be adjusted by the marketing expert to reflect statistical significance issues, budget, time or other issues that he or she may describe.

In these trials, it is anticipated that the interviewers will be district level personnel from MLGL or MOH and possibly enumerators from CSO or MOA. They would come to a central location (probably Gaborone) for training (probably 2-4 days) and materials (instructions, questionnaires, product???) and would return to the field to execute the in household



acceptability trials. Results would be returned to MOH for compilation.

The local consultant will work with MOH in evaluating the acceptability field trials. A report including Tables of results, discussion and conclusions will be prepared and submitted to MOH.

2.3.5 Evaluation of Product Development, Storage Stability Studies, and Market Research and Acceptability Studies. The consultant (or new local consultant) will work with MOH, to take the Acceptability Trials report and those available from Product Development, Storage Stability Studies, Focus Group Studies, and other accumulated information and experience and will summarize them in a critical review providing conclusions and recommendations including a recommendation as to whether or not to proceed to the next Phase, Contracting.

2.3.6 GOB Decision. The Reference committee referring to the "Critical Review" discussed in 2.3.5 above and drawing on the knowledge of the MOH Project Manager and other project resources and documents will make a decision to proceed to contracting, require more development and testing, change the formulation, drop the project, or otherwise indicate their recommendations.

2.4 Contracting

There are no current manufacturers of a low-cost, nutritious weaning food in Botswana. The GOB wishes to purchase a sorghum/soybean based weaning food domestically manufactured using Low-cost-Extrusion Cooking (LEC). Three companies have expressed an interest in supplying the GOB: Foods Botswana at Serowe, Sefalana, and Tswana Holdings at Gaborone.

Foods Botswana, as of March 1989, has an operating LEC system for commercial production of precooked, food grade sorghum and maize meal. The LEC system has 4,368 MT/year capacity operating 24 hours/day, 5 days/week at 100% operating

efficiency. The company also has 9,600 MT/year sorghum milling capacity and estimates actual sorghum milled at 6,000 MT/year. The company appears to have nearly all the equipment and business know-how to produce up to 3,800 MT of weaning food per year. The remainder of the LEC capacity is earmarked for its commercial products.

Sefalana (March 1988) did not have LEC capacity. This company proposed forming a joint venture with another company already established in the weaning food business in order to acquire the technical expertise and build a local plant.

Tswana Holdings indicate they have a 1.2 MT/8 hour extruder and would be interested in supplying a precooked weaning food to the GOB.

Two other companies: Francistown Milling and Trading Company and Olivine Industries at Harare may have an interest in supplying domestically manufactured weaning food to the GOB.

It is the current policy of the GOB to open-up the competition to all companies in Botswana by issuing a "Request for Proposals".

2.4.1 Request for Proposals (RFP). It is visualized that the GOB will issue an RFP that briefly describes the historical development of the project; that comprehensively describes the product desired, its ingredients, the general manufacturing process, and packaging needed; that describes the proposed purchase specifications; that indicates when the product must be available and in what minimum annual tonnage; and that describes the benefits and incentives to be granted to the company(ies) whose proposal(s) is (are) accepted. Considering the small tonnage of 1,629 MT in non-drought years, it would appear there is not room for more than one company. Annex 2 and Annex 3 are two examples of an RFP outline. The MOH with the assistance of a consultant expert in food product development and food process engineering will prepare the RFP.

2.4.2 Issue RFP. Copies are delivered to all known potential manufacturers/suppliers. In addition the availability of the RFP should be advertised in the GOB or commercial business journals.

Potential manufacturers/suppliers are expected to respond to the RFP with detailed proposals on how they propose to manufacture the product (detailed plant layout) and to describe the production capacity, quality control program and facilities, estimated time of product availability, production costs, and their financing and any other information requested in the RFP.

2.4.3 Evaluation of Proposals. MOH in cooperation with MLGL and with the assistance of a consultant with food process engineering and cost analysis will evaluate the proposals received by the deadline using a set of agreed upon evaluation criteria and recommend a course of action. MOH will submit the recommendation, with supporting analysis/documents to the Reference Committee for its action. The Committee is then expected to forward the recommendation through appropriate channels for decision and budgetary consideration.

2.5 Production and Procurement

The MLGL will be responsible for procuring the weaning food from the private sector. The product specifications presented in the RFP can be used to describe the desired product.

One of the manufacturer's requirement should be to segment production into "production lots" and to code (identify the manufacturer and plant) and date each bag in the lot so that it is readily identifiable and traceable. A production lot might be a week or two of production.

The MLGL will need to develop a random, periodic (perhaps every 400 MT) sampling scheme of product delivered to it. Sampling

must be done at the manufacturing plant or at the time of delivery to MLGL. A sample should represent a single production lot and should be a composite of equal sub-samples taken from at least 10 sound bags at different locations in the pile. Composite samples, identified as to production lot and date, are submitted to the MOH Food Laboratory, or other analytical service, to determine if the product is meeting the required purchase specifications. Table 5 gives the list of chemical, physical, and microbiological parameters that should be tested for. Specifically, these are: Moisture, Protein, Fat Crude Fiber, Particle Size, Consistency, Total Plate Count, Pathogens, and Urease Activity.

If the sample does not meet specifications, it must be retained for re-analysis and "as evidence" in the settlement procedure with the manufacturer that is likely to follow. In enforcing the specifications, a discount or penalty schedule is more appropriate than a single "go, no go" level to handle non-critical deviations. Such a suggested discount schedule is also included in Table 5. The discount has to be set high enough so that it is more profitable for the manufacturer to meet the desired specification but not so high as to be confiscatory.

MLGL will need to develop an inventory, inventory rotation, and distribution plan keeping in mind the planned product shelf-life of 6 months under ambient conditions (good warehouse practice).



ANNEX 1

Telcon: D. Fellers to Nigel Nicholson, Foods Botswana, Serowe
Telephone 430268 March 9, 1989

Subject: Weaning Food

1. What types of sorghum should be used in weaning food?

Ans: One needs to be careful about terminology when discussing sorghum. Let us use the GOB classification. There is very little white sorghum commercially available. This year there is bad staining in white, sorghum (color from the glumes leach into the endosperm causing discoloration). White sorghum is OK for making sorghum meal and thus is OK for weaning food. Red sorghums are the ones commercially available. Generally they are better in milling (decortication) quality than white sorghum and give the best sorghum meal as to color and yield. This year, both white and red sorghums have poor milling quality - bran separation is more difficult, meal color is darker, and milling yield is down. Red sorghums are the type that would make up the bulk of sorghum used in weaning food. Bird resistance types sorghums generally have soft endosperm and thus cannot be economically decorticated. Thus there is a natural barrier to the use of bird resistance sorghums in the production of sorghum meal. Bird resistance types are used for malting - because they are about 20% cheaper. In making malt flour, the whole malted sorghum is ground up -- its cost is 25-35% more than sorghum meal. One would need to add about 10% malted sorghum flour to achieve an effect on flavor.

2. How does one keep bird resistance type sorghums out of the sorghum meal?

Ans: Foods Botswana uses a bleaching test developed at Texas A&M University. We reject any red or white sorghum that has more than 5% bird resistance type sorghum in it.

3. Do people in Botswana ferment sorghum meal before making porridge and is the weaning food likely to be fermented?

Ans: Yes, fermentation is popular to improve flavor. The extrusion cooked sorghum has a similar appearance to raw sorghum meal, perhaps a little darker. Since the weaning will probably be perceived as sorghum, it is likely to be fermented

in the traditional way. I don't think this would be a problem (DAF comment: raw sorghum meal has limited sugars available to support fermentation organisms and thus the fermentation proceeds at a slow controlled rate. Pre-cooked sorghum meal with soyflour will have a much higher level of available sugars and fermentation could be very rapid).

4. What is the current soybean situation?

South Africa is always short on soybean and is an importer. Zimbabwe has no soybean for export this year. Soybean meal (defatted) is produced in Zimbabwe and I have heard that some is being used in food products. I will need to check to see if any is available for export. If it is, then the full fat soybean meal could be replaced with defatted soybean meal and vegetable oil. A while back I arranged to get 2 MT of soybeans to make weaning food prototype products. These are currently available to make prototypes for the GOB. Another possibility if soybeans are not available are groundnuts and cowpeas from Malawi. I recently purchased a dehuller for sunflower and have been able to produce some pretty clean meats with no green color (Chlorogenic Acid). However, an 80/20 sorghum/sunflower product would be short on protein.

5. You say you have 2 MT of soybeans that are earmarked for weaning food prototypes for the GOB. What might be the terms of this cooperation?

Ans: I would basically like to cover my costs for materials plus 25 or so percent for overhead.

6. Do you have vitamins and minerals on hand?

Ans: Well yes, we have made arrangements to get the "CSM" specified mix of vitamins and minerals. We can have them on hand in a week or two.

7. Would it be acceptable to have a GOB person or consultant on hand to observe the prototype weaning food development and production?

Ans: Yes.



8. Would Mr. Shoma of Botswana Foods be a reasonable party?

Ans: Yes, I know Mr. Shama and I think he would be good.

9. Do you know Ms. Gomez at ICRISAT?

Ans: Yes, she's working on developing sorghum products.

She might be quite useful in the acceptability studies you are planning. She could help formulate questions for the focus group sessions and for questionnaires in the field studies where weaning foods are placed in the home for 2 weeks to assess acceptance. She could also help/advise on product demonstration during the training of interviewers.

10. DAF advised Mr. Nicholson that current guidance from the GOB-MFDP indicates a demand of 1,629 MT in non-drought years and 5,430 MT in drought years. DAF noted GOB will need about one MT of weaning food for acceptability studies. DAF noted that the CSM phase out date continues to be July 1990. DAF noted there were 10,000 MT CSM currently in storage and would likely meet the need until July 1990. Nicholson questioned that the CSM could be stored that long.

Telecon 3/16/89
Sorghum harvest is July in Zimbabwe. Evidently none will be available this year for export. The sorghum produced in Zimbabwe is animal grade. Though a small amount is used to make TUP by small extension owner. GOB must tell when its feed manufacturing several months to a year before. The weaning food demand so crops can be timed up.

Sorghum stored over 1 year outdoors with tarps over it, goes stale and loses germination viability. Nicholson has also read reports that ~~the~~ the protein quality deteriorates in such sorghum. He controls this factor by rejecting sorghum that has less than 85% germination viability. Another test he runs on the Red or White sorghum for milling is a bleach test (Texas A&M) -- any grain that has 2-4% of unbleachable sorghum or more is rejected for milling.

A float test (Cairnsburg) segregates Bird resistance types from the low tannin Red & White sorghums. Red & White sorghum offered for sale with more than 40% floaters is rejected -- 60 to 70% indicates bird resistant type sorghum.

Nicholson has found that Botswanan customers like a fairly coarse grind in their sorghum meal. His current production is running

+25 mesh 56% + 50 mesh 34% + 80 mesh 7% - 80 mesh 3%.

The Sorghum Millers Assoc do not have standards for Sorghum Meal.

Nicholson will check what happens when the sorghum/soy weaning food is fermented in traditional way of preparing sorghum porridge

ANNEX 2

REQUEST FOR PROPOSAL

RTE FOOD FACTORY

Submitted to:

Submitted by:

January 1, 1986

NOTE: More detail is required from the agency issuing the request for proposal wherever text is [bracketed and underlined].

Proposer responding to the request for proposal must provide information specified wherever TEXT IS CAPITALIZED.

A. BACKGROUND:

[Agency requesting proposals for RTE supplementary food processing plant needs to provide a background statement including:

1. Historical development of project,
2. Objective(s),
3. Scope of project (size, beneficiaries, products, constraints, etc.)
4. Timing (RFP issued, proposals due, evaluation procedure, technical negotiations, contract execution, contract completion), and,
5. Contacts (where questions and proposals should be addressed)]

B. PRODUCT SPECIFICATIONS:

[The contracting agency needs to complete this section. To the extent that these items are not specified in the request for proposal, the proposer will need to provide the information to completely describe the plant being proposed. Items to be covered are:

1. Product - Type(s): Form,
Packaging: Size and type
Quantity of each product type: MT/yr
2. Ingredients - Types:
Quality standards: Moisture
Insect fragments
Aflatoxin
Foreign matters
Protein/oil

3. Product Specifications]:

General Proposal Specification

| <u>Proximate Analysis</u> | <u>Minimum</u> | <u>Maximum</u> |
|---------------------------|----------------|---------------------|
| Moisture, % | -0- | 10.0 |
| Protein (N x 6.25), % | 13.0 | -0- |
| Fat, % | 6.0 | -0- |
| Crude Fiber, % | -0- | 2.5 |
| Total Bacteria/g | -0- | 50,000 ^a |
| Aflatoxin, ppb | -0- | 20 |
| Bulk Density, g/cc | -0- | 0.55 |

| <u>Granulation</u> | <u>% Retained</u> | |
|--------------------|-------------------|----------------|
| | <u>Minimum</u> | <u>Maximum</u> |
| US#6 | -0- | 10 |
| US#30 | 20 | 60 |
| US#60 | 10 | 40 |
| PAN | -0- | 15 |

| <u>Mineral Premix</u> | <u>kg/MT</u> |
|---------------------------------------|--------------|
| Hydrated Dibasic Calcium Phosphate | 6.0 |
| Calcium Carbonate or Ground Limestone | 6.0 |
| Zinc Sulfate Hydrated | 0.04 |
| Ferrous Fumarate or Sulfate | 0.46 |
| Iodized Salt (0.007% I ₂) | 6.5 |
| TOTAL | 19.0 |

| <u>Vitamin Antioxidant Premix</u> | <u>Amounts/MT</u> |
|-----------------------------------|-----------------------------|
| Thiamin Mononitrate | 2.8 g |
| Riboflavin | 3.8 g |
| Pyridoxin Hydrochloride | 1.6 g |
| Niacin | 50.0 g |
| Calcium D-Pantothenate | 28.0 g |
| Folacin | 2.0 g |
| Vitamin B12 | 20.0 mg |
| Vitamin A Palmitate | 16.5 x 10 ⁶ I.U. |
| Vitamin D Palmitate | 2.0 x 10 ⁶ I.U. |
| Alpha-Tocopherol Acetate | 75,000 I.U. |
| Butylated Hydroxy Anisole | 20.0 g |
| Butylated Hydroxy Toluene | 22.0 g |
| Ascorbic Acid | 800.0 g |
| Soy Flour or Starch | 1.5 kg (q.s. ^b) |
| TOTAL | 1.5 kg |

^aSalmonella, E. coli, and Coagulase Positive Staphylococci shall be negative.

^bQuantity sufficient to make the entire mixture up to 1.5 kg.

C. PROPOSAL REQUIREMENTS:

THE PROPOSER NEEDS TO SUPPLY THE FOLLOWING INFORMATION SO THAT A THOROUGH EVALUATION CAN BE MADE OF THE PROPOSAL.

1.0 General Summary Sheet

EACH PROPOSAL SHALL HAVE A GENERAL SUMMARY SHEET AS A COVER WHICH CONTAINS THE FOLLOWING INFORMATION SHOWN IN FIGURE 1:

Figure 1: Summary - Plant Description Sheet

Date:

Offerer:

Cooperating Groups:

Project Reference Number:

Site Location:

Site Lot Size:

Product(s):

Package(s):

Design Operating Schedule:

Costs:

- o Capital Cost:
- o Manufacturing Cost:
 - Per MT:
 - Per Consumer Package:

2.0 Product(s) Description

DESCRIBE IN DETAIL THE PRODUCT(S) WHICH WILL BE PROVIDED IN THE PROPOSED RTE SUPPLEMENTARY FOOD PLANT. FOR EACH PRODUCT, THIS INCLUDES A MINIMUM OF THE FOLLOWING INFORMATION USING THE FORMAT DESCRIBED BELOW:

Product Name:

Quantity Provided: MT/yr

Package Size: Dimensions of package and weight of contents

Package Overwrap or Bailer Information:

| <u>Ingredient Form</u> | <u>Quantity Used</u> | <u>Processing Loss</u> | <u>Finished Product</u> | <u>%</u> |
|------------------------|--------------------------|----------------------------|-----------------------------|----------|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |
| . | | | | |
| . | | | | |
| . | | | | |
| n | | | | |

3.0 Process Description

THE PROPOSER MUST DESCRIBE IN DETAIL THE PROCESS USED TO PRODUCE THE VARIOUS PRODUCT(S) IN THE PROPOSED PLANT. TO PROVIDE AN ACCURATE AND COMPLETE DESCRIPTION, THIS SECTION SHOULD INCLUDE:

3.1 FLOW SHEET SHOWING ALL EQUIPMENT REQUIRED FOR THE CONVEYING AND PROCESSING STEPS. THIS FLOW SHEET NEEDS TO SHOW RECEIPT OF RAW MATERIALS, INCLUDING THEIR FORM, PROCESSING CONDITIONS WHERE CRITICAL TO THE OPERATION, AND THE PROCESSING RATE.

3.2 MATERIAL BALANCE: SHOW THE QUANTITIES OF MATERIAL FLOW THROUGH THE PROCESS ON A PER HOUR BASIS.

IF MULTIPLE PRODUCTS ARE MADE ON A SINGLE PROCESSING LINE OPERATING UNDER DIFFERENT CONDITIONS, CLEARLY SPECIFY ON THE FLOW SHEET HOW THE PROCESSING CONDITIONS OR FLOWS VARY WITH EACH PRODUCT.

Examples of suitable flow sheets and material balance diagrams are shown in Figures 2 and 3.

Figure 2: Flow of Materials

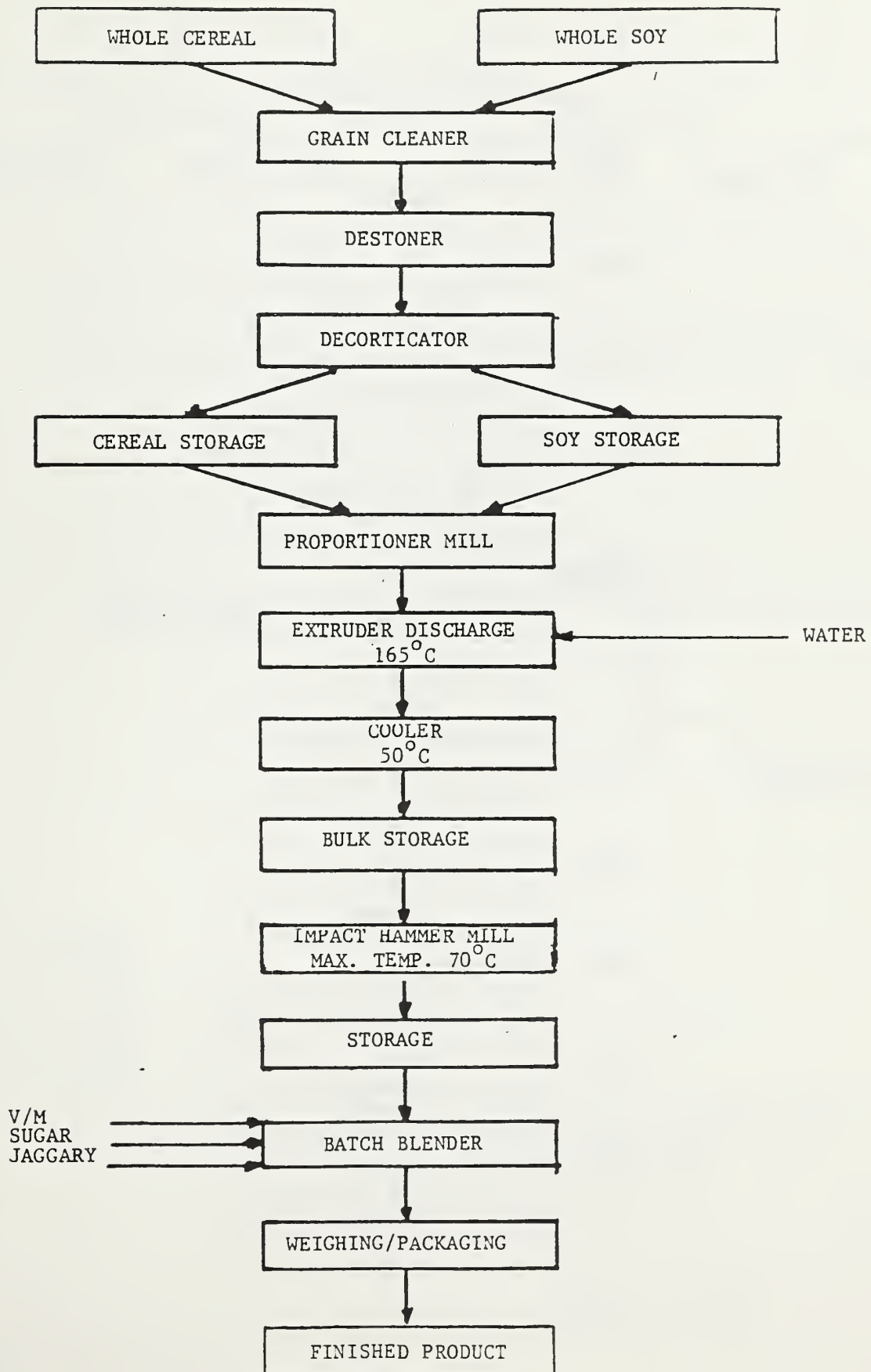
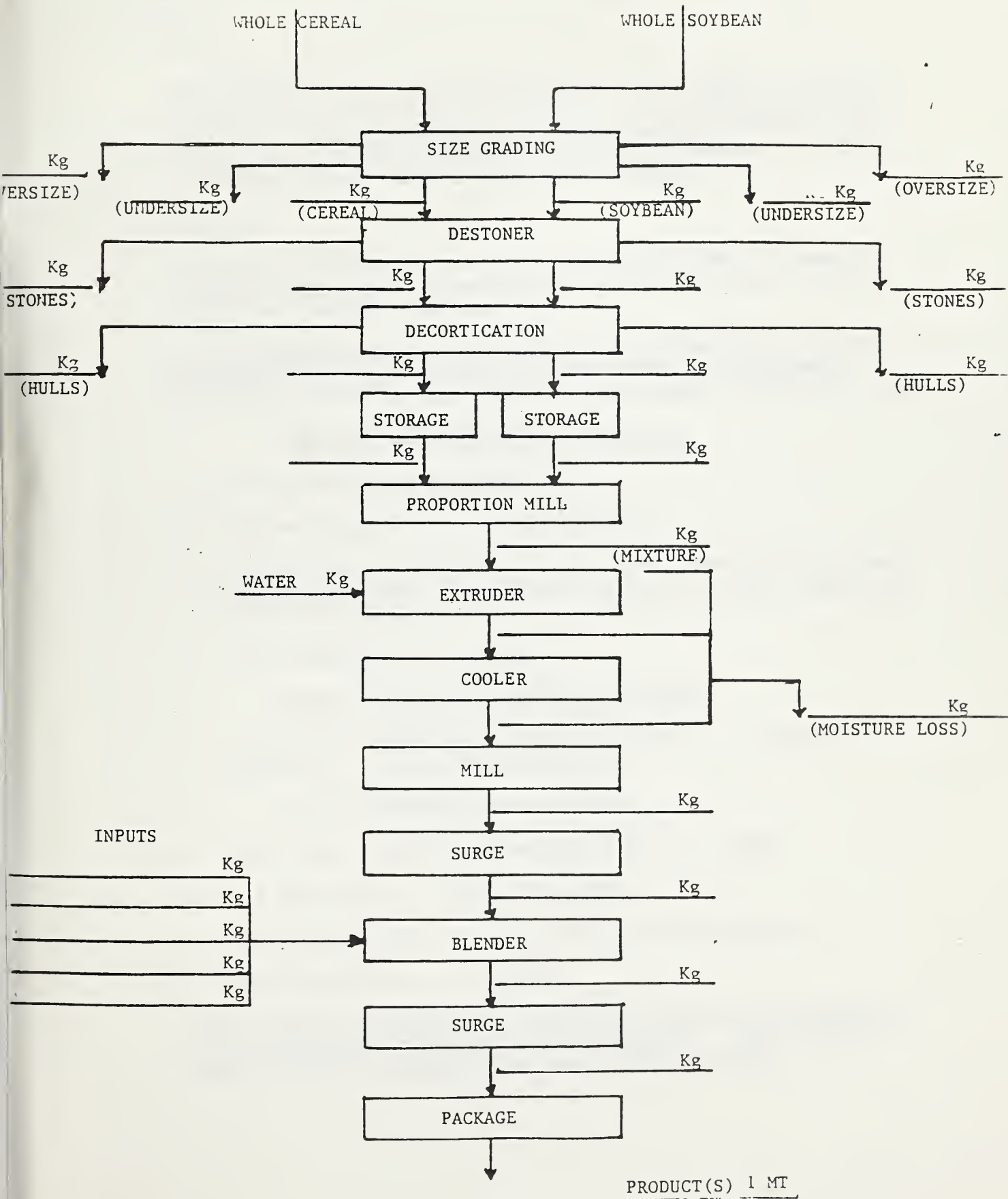




Figure 3: RTE Flour Material Balances
Done on per MT Basis



NOTE: Kg = kg

4.0 Building

4.1 Site

THE PROPOSER NEEDS TO GIVE FULL DETAILS OF THE PROPOSED PLANT SITE, INCLUDING ITS LOCATION, SIZE, LOCATION OF BUILDINGS (EXISTING AND PROPOSED), ROADS, UTILITIES AND ANY OTHER MATTERS PERTINENT TO THE EVALUATION OF ITS SUITABILITY FOR THE PROPOSED PURPOSE. A DRAWING AND DESCRIPTION OF THE SITE NEEDS TO BE PROVIDED.

4.2 Building

A suitable building shall be selected or constructed to house the plant's storage space, processing equipment, laboratory, offices, lavatories, lockers, and canteen.

THE GUIDELINES USED BY THE PROPOSER TO DEFINE THE SIZE OF VARIOUS PLANT AREAS SHOULD BE DESCRIBED IN THE PROPOSAL. FOR EXAMPLE, GUIDELINES FOR THE STORAGE AREAS WHICH HAVE BEEN FOUND SUITABLE ARE:

Raw Material Storage Space Guidelines

1. Bag storage of raw materials.
2. Minimum supply for _____ operating days.
3. Gunny storage requiring a _____ lb/ft² loading and 75% space utilization factor. Bags are 1.5 ft x 2.5 ft and 8" thick when filled with 100 lbs.
4. Plant operation - _____ hr/day.

Finished Product Storage Space Guidelines

1. Paper/fabric master bag storage containing _____ packages of product in _____ kg consumer packages.
2. _____ days of finished product storage.
3. Master bags cannot be stacked higher than _____ bags.
4. Each bag holds _____ lb(s) of product.
5. Floor loading of _____ lb/ft² and 75% utilization.
6. Plant operation - _____ hr/day.

ACTUAL FLOOR SPACE WHICH WILL BE ALLOTTED TO THE VARIOUS FUNCTIONS IN THE PLANT MUST BE DESIGNATED IN THE PROPOSAL. THE FOLLOWING TABLE DESCRIBES THE FORMAT TO BE USED FOR THIS PURPOSE.

Building Floor Space Schedule

| <u>Building Area</u> | <u>Width</u> <u>(m)</u> | <u>Length</u> <u>(m)</u> | <u>Area</u> <u>(m²)</u> | <u>Minimum</u> <u>Height</u> <u>(m)</u> |
|---|----------------------------|-----------------------------|---------------------------------------|---|
| o Raw Material Storage | | | | |
| Form & Quantities of Materials to Be Stored | | | | |
| o Processing | | | | |
| - Cleaning/dehulling | | | | |
| - Processing Equipment | | | | |
| - Vitamin/Mineral Storage | | | | |
| - Blending | | | | |
| o Packaging | | | | |
| - Equipment | | | | |
| - Packaging Materials | | | | |
| o Finished Product Storage | | | | |
| o Workshop and Stores | | | | |
| o Quality control lab | | | | |
| o Office | | | | |
| o Restroom/Lockers | | | | |
| - Men's | | | | |
| - Women's | | | | |
| o Canteen | | | | |

IT SHALL BE THE RESPONSIBILITY OF THE PROPOSER TO ENSURE ADHERENCE TO LOCAL REGULATIONS AND DEVELOP A BUILDING DESIGN WHICH WILL PROVIDE THE FUNCTIONAL AREA REQUIREMENTS LISTED ABOVE. THE PROPOSAL NEEDS TO COMPLETELY DESCRIBE THE ACTUAL BUILDING SPECIFICATIONS WHICH ARE BEING PROPOSED.

TO FULLY DESCRIBE THE BUILDING IN WHICH THE RTE FOOD FACTORY WILL BE HOUSED, DRAWINGS SHALL BE PROVIDED WITH THE PROPOSAL. THESE NEED TO GIVE BOTH PLAN AND ELEVATION VIEWS OF SUFFICIENT DETAIL FOR THE REVIEWERS TO EVALUATE THEIR SUITABILITY.

Building specification guidelines for the RTE food processing plant follow:

General Specifications

The building shall be leakproof, rodent-proof, and of air-tight construction. The air-tight requirement shall be applicable only when fumigation is utilized requiring all openings on the building to be closed.

The building shall be designed so that the major areas listed in the Building Floor Space Schedule are separated by walls extending the full height of the building. Suitably sized doors, no smaller than 6 ft wide x 7 ft high (1.8 m x 2.1 m), shall be provided for passage between storage and main building areas.

Access to building areas from the outside shall be provided. This access shall be suitably sized for receiving and removing equipment. Its recommended size shall be 9 ft high x 10 ft wide (7.8 m x 3.03 m).

Building Walls

1. Walls shall be constructed of materials commonly used locally. Suggested materials and finishes are listed below.

| <u>Wall Material</u> | <u>Interior Finish in Processing & Packaging Areas</u> |
|-----------------------------|--|
| Brick & Mortar | Stucco or plaster, smooth, painted |
| Concrete Block | Plaster, smooth, painted |
| Wood | Sealed, painted |
| Corrugated Galvanized Steel | Gypsum board material, smooth, painted |
| Corrugated asbestos | Gypsum board material, smooth, painted |

2. Walls shall be painted by either spray or brush. Paint shall not contain lead and shall be capable of wash-down with water and mild detergent.
3. Exterior walls shall be capable of a minimum dead load of 55 lb/ft² (2.64 kPa).

Adjustments for wind and/or earthquake loadings are to be made where the geography warrants such consideration.

Floors

1. Building floors shall be steel-reinforced concrete. Floor areas, excluding machinery areas, shall be capable of withstanding a minimum live load of 200 lb/ft² (9.6 kPa). Floors in machinery areas shall be capable of bearing concentrated loads necessary to support machinery.
2. Concrete floors shall be pitched toward outside floors with a floated surface finish.
3. Concrete floors shall be sealed with materials which are resistant to: alkali, strong acid, soap, mineral oil, grease, water, and vegetable oil.
4. A sealer shall be applied after all of the installation is complete, but prior to production.

Roof and Roof Structures

1. Roof coverings for the building shall be durable and resist a loading of at least 100 lbs/ft² (4.8 kPa) of horizontal projection. The covering shall be supported by a truss structure over the building areas which is capable of withstanding the above loading. For safety reasons, independent steel support walkways shall be provided for access to various external plant equipment when roof covering materials have less than the above specified loading.
2. Trusses may be exposed on the inside of the building. To reduce infestation problems, they should be free, if possible, from upturned channels or troughs which can collect and trap dust and/or harbor pests.
3. Suitable roofing materials shall include corrugated asbestos, corrugated galvanized steel, or wood with composition shingle.
4. All roofing seams will be sealed with a nonsetting sealer, and fasteners shall have self-sealing capability.
5. Roof/wall intersections shall be constructed with proper flashings and a sealer which is compatible with the roofing material so that the building can be tightly sealed for fumigation purposes.

Building Support Frame

1. The support structure shall be steel beam construction.
2. The building structure shall be clear span type, single beam, or truss type, which will accommodate equipment heights within the processing areas.
3. Exposed steel supports and trusses shall be smooth and painted.
4. Primary structural members supporting the roof should be capable of carrying safely a concentrated load of at least 2,000 pounds (909 kg) or higher as required by the proposed design.

Windows

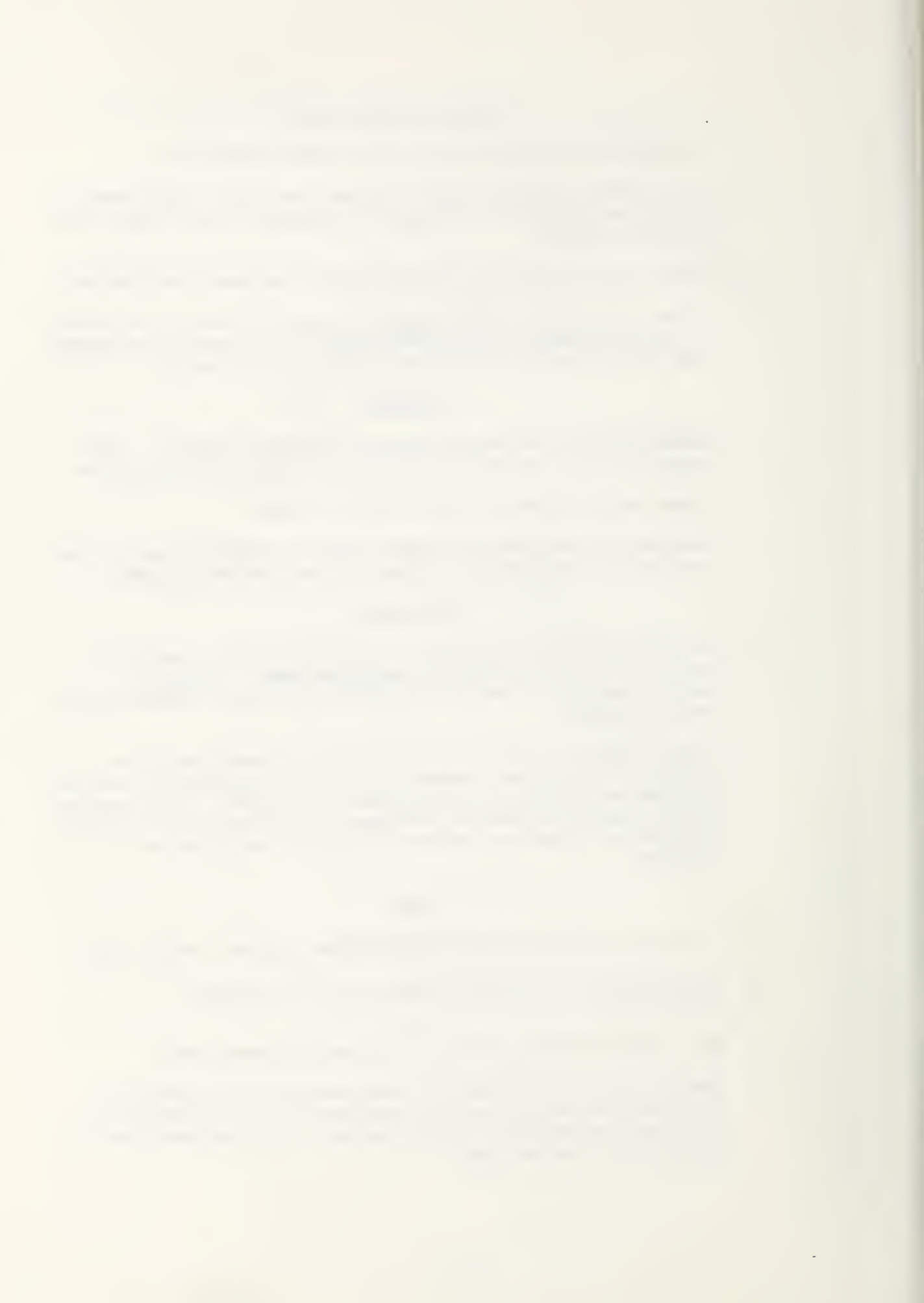
1. Windows shall be either painted wood frame or aluminum. Each frame will contain glass so they can be sealed for fumigation.
2. Frames shall be sealable when window is shut.
3. Each window shall have an 8-mesh screen to prevent insects from entering the building when opened for ventilation purposes.

Ventilation

1. The building will be equipped with exhaust fans to remove hot moist air from processing and packaging areas. Complete exchange of air in these areas should be done on a frequency of every 5 minutes.
2. Special exhaust hoods and/or ventilation systems should be provided for extruder, roasters, and coolers to prevent heat and moisture buildup around these pieces of equipment. Such special ventilation is necessary to maintain a suitable working environment for employees and prevent a buildup of moisture on equipment.

Doors

1. All doors shall be suitably constructed from wood and/or metal.
2. Rail-sliding or hinge-type doors shall be considered satisfactory.
3. All doors shall have provision for sealing when closed.
4. Each door shall also have an 8-mesh screen unit to prevent or minimize insects from entering the plant. This screen unit shall have an automatic closing device so that the door remains shut unless in actual use.



5. All exterior doors should swing out from the building to allow easy egress in case of emergency.

Building Materials

1. Steel - Standard 1040 carbon steel shall be permitted. All exposed steel shall be primed and painted.
2. Wood - Any wood type shall be considered acceptable for building and trim. Wood must be free from all insect life. Wood shall be sealed and painted.
3. Concrete - Standard concrete mixes shall be considered satisfactory. Mixes must conform to established local codes.

GENERAL SPECIFICATIONS FOR PLANT UTILITIES ARE SUGGESTED. THE PROPOSER MUST PROVIDE A COMPLETE DESCRIPTION OF THE UTILITIES WHICH WILL BE PROVIDED FOR THE RTE FOOD PROCESSING PLANT WHICH IS BEING PROPOSED.

Utilities

1. Water - A good, clean potable water supply shall be provided with a capacity for 40 gallons (151 liters) per capita occupancy per day at a recommended pressure of no less than 20 psi (140 kPa). Water conduits shall be of acceptable material such as PVC (polyvinylchloride), copper, brass, or galvanized steel. If a gravity pressure system is employed, a booster pump shall be provided for the processing area. The booster shall be capable of providing water at 50 psi (350 kPa). Water tap distribution is recommended according to the following schedule.

Water Tap Schedule

| <u>Building Area</u> | <u>Number of Taps</u> |
|----------------------|-----------------------|
| 1. Processing | 1 |
| 2. Workshop | 1 |
| 3. Quality control | 1 |
| 4. Men's restroom | 10 |
| 5. Women's restroom | 10 |
| 6. Canteen | 3 |
| 7. Packaging | 1 |

Hot water taps, if provided, shall be appropriated as per the water tap schedule, except for the restrooms where five each shall be provided.

2. Sewer - Where possible, a central sewer service should be used. An acceptable alternative is a septic tank with a properly designed leach field.

Suitable sewage conduit shall be used to connect facilities to the main sewer line or septic tank. Acceptable conduits include vitrified clay, reinforced concrete, PVC or cast iron. For those instances when pipe is not available, sewers may be constructed of formed channels; however, they shall not be of an open type. Sewer connections shall be provided to each location where a water tap is provided as given in the Water Tap Schedule.

5.0 Electrical (General Building)

- 5.1 All electrical wiring for lights, plugs, etc., shall conform to applicable local codes.
- 5.2 Wires shall be enclosed in metal or plastic conduit.
- 5.3 Conduit and wire connections must be properly made and unexposed.
- 5.4 Lighting shall be of either incandescent or fluorescent type. Each light fixture in the processing areas shall have a translucent protective cover. Suggested lighting levels are as follows:
 - a. Storage areas 20 foot candles or 215 lm/m^2
 - b. Processing/packaging area . . . 100 foot candles or 1076 lm/m^2
 - c. Offices & laboratories 150 foot candles or 1614 lm/m^2
 - d. Lavatories/lockers/canteen . . 100 foot candles or 1076 lm/m^2
- 5.5 All plugs and switches shall be the grounding type and unbreakable.
- 5.6 Transformers shall be located a minimum of 100 ft (20 m) from the building.
- 5.7 All electrical circuits must be protected by suitable circuit breakers or fuses in accordance with local codes.
- 5.8 Motor control centers shall contain motor starters with push button start/stops and pilot lights. These starters should have the provision to allow locking out individual motors to prevent accidental start during equipment repair and inspection.

6.0 Processing and Packaging Machinery

The processing and packaging machinery which will be used in the RTE food factory shall be designed and constructed for use in processing human food. This means that all surfaces in contact with food must be capable of being exposed for cleaning and inspection. Materials of which processing equipment are constructed will not contaminate food in any manner. Contact surfaces will not be painted or coated, especially with materials which could contaminate the food. Grease or other lubricants must not contact food materials, and devices to prevent this contact and contamination need to be in place. Equipment must be free of cracks or pockets which could harbor insects, vermin or other undesirable materials or substances.

All equipment will be connected to the electrical supply in a manner so that they can be individually controlled. Positive lock out switches will be used so that equipment can be absolutely removed from service during inspection, cleaning or servicing.

Proper instrumentation requiring easy exposure on all processing equipment of all surfaces having contact with the food product will assure that necessary processing conditions are attained and maintained.

Safety shields on belts, drives, cutters, mills or other moving parts need to be supplied to provide workers with protection from entanglement and injury.

Equipment needs to be protected with screens and magnets to prevent tramp metal from entering the product stream.

Supports and frames for equipment should be constructed in such a manner that they can be cleaned and will not harbor insects, vermin or other undesirable materials. Supports should be painted a light color to make inspection and cleaning easier.

Insulation on equipment needs to be protected and completely covered so that it does not become contaminated with the food product or so it cannot contaminate or enter the food processing stream.

THE PROPOSER SHALL PROVIDE A COMPLETE LIST OF ALL PROCESSING AND PACKAGING EQUIPMENT TO BE USED IN THE RTE FOOD FACTORY. THIS LIST SHALL INCLUDE:

1. Manufacturer
2. Ordering specifications
3. Motor(s) requirements — Full load current, frequency, phase, voltage

4. Cost

- a. Equipment
- b. Shipping
- c. Other (itemize)

5. Itemized spare parts list for one year operation and cost

IN ADDITION TO THE DETAILED INFORMATION ON THE PROCESSING AND PACKAGING EQUIPMENT, THE PROPOSER SHALL PROVIDE A PLAN AND ELEVATION DRAWINGS SHOWING HOW THE PROPOSED EQUIPMENT WILL BE INSTALLED IN THE PROCESSING PLANT. THESE DRAWINGS WILL BE IN SUFFICIENT DETAIL TO ALLOW AN ENGINEERING EVALUATION OF THE SUITABILITY OF THE PROPOSED DESIGN.

7.0 Other Equipment

IN ADDITION TO A DETAILED LIST OF PROCESSING AND PACKAGING EQUIPMENT, THE PROPOSER NEEDS TO SUPPLY A LIST OF ANCILLARY EQUIPMENT AND SUPPLIES FOR THE RTE FOOD FACTORY. THESE INCLUDE:

1. Shop equipment;
2. Maintenance equipment;
3. Miscellaneous handling and warehousing equipment;
4. Quality control;
5. Office; and,
6. Other.

THESE LISTS SHALL INCLUDE A GENERAL DESCRIPTION AND ASSOCIATED COSTS OF THIS EQUIPMENT.

3.0 Quality Control

THE PROPOSER WILL DEFINE THE QUALITY CONTROL TESTING WHICH WILL BE PERFORMED ON THE RAW AND FINISHED PRODUCTS. THIS SECTION SHOULD DESCRIBE:

1. Specific tests to be run, including the test procedure;
2. Sampling procedures;
3. Frequency of tests;
4. Procedures to be used to assure accurate correlation of results with specific samples (product coding); and,
5. Standards to be used to judge adequacy of samples and limits to be used to reject materials.

These tests will not necessarily be run at the plant site; however, routine quality tests must be performed there so that required manufacturing adjustments can be made in a timely manner to assure that all products meet minimum quality standards.

Suggested routine tests which should be performed are:

Raw Materials:

- o Insect fragments
- o Aflatoxins
- o Dirt, stones, offal
- o Density
- o Moisture

Finished Product:

- o Particle size distribution
- o Consistency/viscosity
- o Taste
- o Package integrity
- o Moisture

Tests which may be performed off the plant site on a less frequent basis:

Finished Product:

- o Proximate analysis
- o Nutritional analysis (PER)
- o Microbiological analysis
 - Total aerobic plate count
 - Staphylococci
 - Salmonella
 - E. coli
- o Storage tests

9.0 Costs

THE PROPOSER SHALL PROVIDE A COMPLETE AND DETAILED COST ANALYSIS. THE COST ANALYSIS SHALL CONSIST OF THE FOLLOWING PARTS:

9.1 Capital Costs

THE PROPOSER WILL PROVIDE A CAPITAL COST ANALYSIS HAVING THE FOLLOWING MINIMUM DETAIL:

- a. Land (area and cost)
- b. Site Development (grading, roads, utilities and other development costs)
- c. Building [(area), (cost/area), and (total cost) for each of the following]
 - o Raw material storage
 - o Processing
 - o Packaging
 - o Finished product storage
 - o Workshop and stores
 - o Quality control lab
 - o Office
 - o Laboratory and Locker Room
 - o Canteen

Total

- d. Equipment
 - o Warehouse
 - o Cleaning/dehulling
 - o Processing
 - o Grinding/blending
 - o Packaging
 - o Laboratory
 - o Spare parts
 - o Electrical
 - o Office
 - o Other

Total

- e. Installation/Startup
- f. Engineering/Architect
- g. Contingency
- h. Total Capital Costs

9.2 Manufacturing Costs

THE PROPOSER WILL PROVIDE A COMPLETE BREAKDOWN ON MANUFACTURING COSTS FOR A YEAR'S PRODUCTION, INCLUDING PER UNIT COSTS OF RAW MATERIALS, LABOR, UTILITIES, PACKAGING MATERIALS, ETC. A SUITABLE FORMAT FOR THIS ANALYSIS IS:

o Raw Ingredients Quantity Price/Unit Yield Cost

(List individually)

o Labor Category Number Wage Benefits Cost

(List each category of labor within the following subsections)

- Production
- Administration
- Maintenance and Other
- Quality Control
- Sales and Distribution

o Utilities Quantity Price/Unit Cost

- Electricity
- Water
- Fuel

o Packaging Quantity Price/Unit Cost

- Bag
- Liner
- Bailer

o Repairs & Maintenance

- Equipment
- Building
- Other

o Depreciation Rate

- Building
- Equipment

o Distribution (Detail costs included)

o Financial Expenses (Cost of borrowed capital)

o Insurance, Taxes & Other Costs

o Indirect Costs (Explain fully)

| <u>o Total Cost</u> | <u>W/Ingredients</u> | <u>W/O Ingredients</u> |
|-----------------------------|----------------------|------------------------|
| - Cost per MT | | |
| - Cost per kg | | |
| - Cost per consumer package | | |



10.0 Offerer

10.1 PROPOSER SHOULD GIVE DETAILED INFORMATION ABOUT ITS ORGANIZATION:

- A. Organization and structure;
- B. Previous business experience relevant to project;
- C. Scope of current operations;
- D. Background on key personnel;
- E. Financial details; and,
- F. Banking references

10.2 IN ADDITION, THE PROPOSER SHOULD GIVE DETAILS ON ALL KEY ADMINISTRATIVE, TECHNICAL, SALES AND MARKETING PERSONNEL WHO WILL BE ASSIGNED TO THE PROJECT.

11.0 Terms and Conditions

PROPOSER SHOULD PROVIDE SPECIFIC DETAILS ON TERMS AND CONDITIONS ASSOCIATED WITH ITS OFFER. THESE INCLUDE:

- A. Negotiator who will address specific issues or clarification of the proposal;
- B. Acceptance conditions of offer;
- C. Payment schedule;
- D. Term of contract; and,
- E. Other related items.

ANNEX 3

OUT LINE FOR REQUEST FOR PROPOSAL

A. COST ESTIMATES

1. Capital Costs

- Land-building (including location, size facilities, accessibility etc.)
- Equipment (description - source)

2. Raw Materials (Based on producing 300 MT/PY.

- Local (cost and source)
- External (cost and source)

3. Operating Costs

- Administrative (key personnel, total salaries = benefits, furnishing, fixtures, insurance, communication)
- Utilities (electricity etc)
- Maintenance (parts and labour)
- Transportation (including fuel)
- Depreciation

4. Marketing Costs

- Distribution sales
- Advertising, promotion, merchandising
- Market research

5. Financing Plan

- Source
- Terms
- Annual Cost

B. IMPLEMENTATION STRATEGIES

1. Training procedures
2. Quality control
3. Marketing strategy
 - Production volume projection
 - Pricing
 - Distribution
 - Promotion
 - Market research
4. Anticipated concessions required from investment bureau

C. FINANCIAL AND COST ANALYSES

1. Pricing Indicators
 - Estimated cost per MT produced
 - Estimated cost per MT sold
 - Estimated income per MT sold
2. Operational Budget (12 months)
 - Expenditure (itemised)
 - Project gross turnover-sales
 - Project net income
 - Projected profit/loss

D. PROJECT COMMISSIONING TIME LINE

- Plant commissioning
- Marketing implementation

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